

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C. 20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 03 May 2000 (03.05.00)	
International application No. PCT/US99/13551	Applicant's or agent's file reference BAND0101PCT
International filing date (day/month/year) 16 June 1999 (16.06.99)	Priority date (day/month/year) 16 June 1998 (16.06.98)
Applicant ISLAM, Mohammed, Nazrul et al	

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

14 January 2000 (14.01.00)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer</p> <p>Juan Cruz</p> <p>Telephone No.: (41-22) 338.83.38</p>
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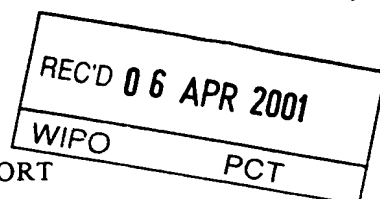
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



Applicant's or agent's file reference BAND0101PCT	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US99/13551	International filing date (day/month/year) 16 JUNE 1999	Priority date (day/month/year) 16 JUNE 1998
International Patent Classification (IPC) or national classification and IPC IPC(7): H01S 3/10, 3/30 ; G02B 6/00 and US Cl.: 359/334,337,341; 372/3,6		
Applicant [BANDWIDTH SOLUTIONS INC] XTERA COMMUNICATIONS, INC		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets.
☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority. (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 0 sheets.

3. This report contains indications relating to the following items:
 - I ☒ Basis of the report
 - II ☐ Priority
 - III ☐ Non-establishment of report with regard to novelty, inventive step or industrial applicability
 - IV ☒ Lack of unity of invention
 - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - VI ☐ Certain documents cited
 - VII ☐ Certain defects in the international application
 - VIII ☐ Certain observations on the international application

Date of submission of the demand 14 JANUARY 2000	Date of completion of this report 16 MARCH 2001
Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	Authorized officer NE: LSON MOSKOWITZ <i>Dean Gorbunov</i>
Facsimile No. (703) 305-3230	Telephone No. (703) 306-4165

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US99/13551

I. Basis of the report

1. This report has been drawn on the basis of *(Substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments):*

☒ the international application as originally filed.

☒ the description, pages 1-46 , as originally filed.

pages NONE , filed with the demand.

pages NONE , filed with the letter of _____.

pages _____ , filed with the letter of _____.

☒ the claims, Nos. 1-50 , as originally filed.

Nos. NONE , as amended under Article 19.

Nos. NONE , filed with the demand.

Nos. NONE , filed with the letter of _____.

Nos. _____ , filed with the letter of _____.

☒ the drawings, sheets/fig 1-13 , as originally filed.

sheets/fig NONE , filed with the demand.

sheets/fig NONE , filed with the letter of _____.

sheets/fig _____ , filed with the letter of _____.

2. The amendments have resulted in the cancellation of:

☒ the description, pages NONE .

☒ the claims, Nos. NONE .

☒ the drawings, sheets/fig NONE .

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the ~~Supplemental Box~~ Additional observations below (Rule 70.2(c)).

4. Additional observations, if necessary:

NONE

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US99/13551

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
- ☒ paid additional fees.
- ☐ paid additional fees under protest.
- ☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.
- ☒ not complied with for the following reasons:

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☒ all parts.
- ☐ the parts relating to claims Nos. .

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US99/13551

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. STATEMENT**

Novelty (N)	Claims <u>1-50</u>	YES
	Claims <u>NONE</u>	NO
Inventive Step (IS)	Claims <u>12-23 and 32-50</u>	YES
	Claims <u>1-11 and 24-31</u>	NO
Industrial Applicability (IA)	Claims <u>1-50</u>	YES
	Claims <u>NONE</u>	NO

2. CITATIONS AND EXPLANATIONS

Claim 1-11 and 24-31 lack an inventive step under PCT Article 33(3) as being obvious over Grubb et al in view of Hansen et al. Grubb et al also disclose the claimed invention except for the optical fiber dispersion compensator. Hansen et al the use of fiber optic dispersion compensators in optical amplifiers to maximize transmission distance. Therefore it would have been obvious to one skilled in this art to use an optical fiber dispersion compensator in Grubb et al.

Claims 12-23 and 32-50 meet the requirements under PCT Articles 33(2-4) of novelty and inventive step as the pumping mechanism of claim 12, the addition of longer and shorter wavelengths of claim 32, and the use of plural nonlinearly interacting pump bands per claim 37, are not taught or fairly suggested by the prior art.

----- NEW CITATIONS -----

NONE

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: DAVID R. SYROWI
BROOKS & KUSHMAN
1000 TOWN CENTER
TWENTY-SECOND FLOOR
SOUTHFIELD, MICHIGAN 48075

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference BAND0101PCT	Date of Mailing (day/month/year) 11 JAN 2000
International application No. PCT/US99/13551	International filing date (day/month/year) 16 JUNE 1999
Applicant BANDWIDTH SOLUTIONS INC.	

Due: 3-11-2000

1. ☒ The applicant is hereby notified that the international search report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:
The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the international search report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in rules 90 bis 1 and 90 bis 3, respectively, before the completion of the technical preparations for international publication.

Within 19 months from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within 20 months from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer <i>Dean Moskowitz</i> NELSON MOSKOWITZ Telephone No. (703) 306-4165
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference BAND0101PCT	<div style="display: flex; justify-content: space-between;"> <div>FOR FURTHER ACTION</div> <div>see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5</div> </div>
International application No. PCT/US99/13551	<div style="display: flex; justify-content: space-between;"> <div>International filing date (day/month/year) 16 JUNE 1999</div> <div>(Earliest) Priority Date (day/month/year) 16 JUNE 1998</div> </div>
Applicant BANDWIDTH SOLUTIONS INC.	

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 5 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. ☐ Certain claims were found unsearchable (See Box I).

2. ☒ Unity of invention is lacking (See Box II).

3. ☐ The international application contains disclosure of a nucleotide and/or amino acid sequence listing and the international search was carried out on the basis of the sequence listing

☐ filed with the international application.
☐ furnished by the applicant separately from the international application,

☐ but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.

☐ transcribed by this Authority.

4. With regard to the title,

☐ the text is approved as submitted by the applicant.
☒ the text has been established by this Authority to read as follows:

FIBER-OPTIC COMPENSATION FOR DISPERSION, GAIN TILT, AND BAND PUMP NONLINEARITY.

5. With regard to the abstract,

☐ the text is approved as submitted by the applicant.
☒ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is:
 Figure No. 1

☒ as suggested by the applicant.
☐ because the applicant failed to suggest a figure.
☐ because this figure better characterizes the invention.

☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US99/13551

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐

The additional search fees were accompanied by the applicant's protest.

☒

No protest accompanied the payment of additional search fees.

CHAPTER I
PCT TELEPHONE MEMORANDUM
FOR
LACK OF UNITY OF INVENTION



PCT No.: PCT/US99/13551

EXAMINER: NELSON MOSKOWITZ

ATTORNEY SPOKEN TO: DAVID R. SYROWIK

DATE OF CALL: 23 AUGUST 1999

- ☒ AMOUNT OF PAYMENT APPROVED: \$280.00
- ☒ DEPOSIT ACCOUNT NUMBER TO BE CHARGED: 02-3978
- ☒ ATTORNEY ELECTED TO PAY FOR ALL ADDITIONAL INVENTIONS
- ☐ ATTORNEY ELECTED TO PAY ONLY FOR THE ADDITIONAL INVENTIONS COVERED BY
- ☐ GROUP(S):
- ENCOMPASSING -
- ☐ CLAIM(S):
- ☐ ATTORNEY ELECTED **NOT** TO PAY FOR ANY ADDITIONAL INVENTIONS, THEREFORE, ONLY THE FIRST CLAIMED INVENTION (GROUP I) COVERED BY CLAIM(S) _ HAS BEEN SEARCHED.
- ☒ ATTORNEY WAS ORALLY ADVISED THAT THERE IS NO RIGHT TO PROTEST FOR ANY GROUP NOT PAID FOR.
- ☒ ATTORNEY WAS ORALLY ADVISED THAT ANY PROTEST MUST BE FILED NO LATER THAN 15 DAYS FROM THE MAILING OF THE SEARCH REPORT (PCT/ISA/210).

Time Limit For Filing A Protest

APPLICANT IS HEREBY GIVEN 15 DAYS FROM THE MAILING DATE OF THIS SEARCH REPORT IN WHICH TO FILE A PROTEST OF THE HOLDING OF LACK OF UNITY OF INVENTION. IN ACCORDANCE WITH PCT RULE 40.2, APPLICANT MAY PROTEST THE HOLDING OF LACK OF UNITY ONLY WITH RESPECT TO THE GROUP(S) PAID FOR.

Detailed Reasons For Holding Lack of Unity Of Invention:
(Continued on a separate sheet)

Note: A copy of this form must be attached to the Search Report.

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING

This ISA found multiple inventions as follows:

This application contains the inventions or groups of inventions which are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional fees must be paid.

Group I, claim(s) 1-32, drawn to an optical signal transmission system compensating for dispersion and balancing optical loss by a pumped distributed gain medium.

Group II, claim(s) 32-36, drawn to a method for minimizing gain tilt by adding wavelength bands to minimize energy changes.

Group III, claim(s) 37-50, drawn to a fiber optic transmission system comprising plural band pumps and means for orthogonalizing adjacent band pumps.

The invention listed as Groups I, II, and III do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2 they lack the same or corresponding special technical features for the following reasons: Group I requires a distributed gain medium which is not required in the claims of the other two groups; Group II requires gain tilt equilization which is not required in the claims of the other two groups; Group III requires plural pump bands and orthogonally adjacent band pumps which is not required in the claims of the other two groups. Furthermore, the three groups are subcombinations usable together.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/13551

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : H01S 3/10, 3/30 ; G02B 6/00

US CL : 359/334, 337, 341; 372/3, 6

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 359/124, 160, 334, 337, 341; 372/3, 6

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

INSPEC, COMP, JAPIO, APS; search terms are attached hereto.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,623,508 A (GRUBB et al) 22 April 1997 (22/04/97) columns 1-3.	1-12, 24-31
Y	Hansen et al, 10 Gb/s, 411 km repeaterless transmission experiment employing dispersion, 21st European Conference on Optical communication, 17-21 September 1995. Vol. 2.	1-11, 24-31
A, P	US 5,778,014 A (ISLAM) 07 July 1998 (07/07/98).	1-50

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
B earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*A* document member of the same patent family
O document referring to an oral disclosure, use, exhibition or other means	
P document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 09 SEPTEMBER 1999	Date of mailing of the international search report 11 JAN 2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-7687	Authorized officer <i>Dr. Nelson Moskowitz</i> NELSON MOSKOWITZ Telephone No. (703) 306-4165

Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

An apparatus and method are described for combining optical amplification and dispersion compensation in a Raman amplifier (Fig. 4a). Dispersion-Managing Raman Amplifier (DMRA) (Fig. 4a) combines Raman amplification with dispersion compensation by selecting the length and dispersion of the gain fiber (100) to balance the dispersion of the link. The pumping level is adjusted to balance the losses from the gain fiber (100) and transmission link (130). For WDM transmission systems based on dispersion-shifted fiber (DSF), operation in the "violet band" between 1430-1530nm is based on Raman amplification. By using a DMRA (550), a dispersion (510) and nonlinearity managed system can be implemented. Furthermore, gain equalization can be added to the DMRA by cascading one or two Mach-Zehnder frequency filters. The invention also includes a method for symmetrically adding channels below and above the C-band, the gain tilt within the C-band can be minimized. To minimize the interaction between pumps for different bands (Fig. 16d), alternate band pumps can be spatially dispersed and/or cross-polarized (Fig. 16d).

**ATTACHMENT TO CHAPTER I PCT TELEPHONE MEMORANDUM
FOR
LACK OF UNITY OF INVENTION**

Detailed Reasons For Holding Lack Of Unity Of Invention:

THIS APPLICATION CONTAINS THE FOLLOWING INVENTIONS OR GROUPS OF INVENTIONS WHICH ARE NOT SO LINKED AS TO FORM A SINGLE INVENTIVE CONCEPT UNDER PCT RULE 13.1. IN ORDER TO BE SEARCHED, THE APPROPRIATE ADDITIONAL SEARCH FEES MUST BE PAID.

GROUP I, CLAIM(S) 1-32, DRAWN TO AN OPTICAL SIGNAL TRANSMISSION SYSTEM COMPENSATING FOR DISPERSION AND BALANCING OPTICAL LOSS BY A PUMPED DISTRIBUTED GAIN MEDIUM.

GROUP II, CLAIM(S) 32-36, DRAWN TO A METHOD FOR MINIMIZING GAIN TILT BY ADDING WAVELENGTH BANDS TO MINIMIZE ENERGY CHANGES.

GROUP III, CLAIM(S) 37-50, DRAWN TO A FIBER OPTIC TRANSMISSION SYSTEM COMPENSATING PLURAL BAND PUMPS AND MEANS FOR ORTHOGONALIZING ADJACENT BAND PUMPS.

THE INVENTION LISTED AS GROUPS I, II AND III DO NOT RELATED TO A SINGLE INVENTIVE CONCEPT UNDER PCT RULE 13.1 BECAUSE, UNDER PCT RULE 13.2 THEY LACK THE SAME OR CORRESPONDING SPECIAL TECHNICAL FEATURES FOR THE FOLLOWING REASONS: GROUP I REQUIRES A DISTRIBUTED GAIN MEDIUM WHICH IS NOT REQUIRED IN THE CLAIMS OF THE OTHER TWO GROUPS: GROUP II REQUIRES GAIN TILT EQUALIZATION WHICH IS NOT REQUIRED IN THE CLAIMS OF THE OTHER TWO GROUPS: GROUP III REQUIRES PLURAL PUMP BANDS AND ORTHOGONALLY ADJACENT BAND PUMPS WHICH IS NOT REQUIRED IN THE CLAIMS OF THE OTHER TWO GROUPS. FURTHERMORE, THE THREE GROUPS ARE SUBCOMBINATIONS USABLE TOGETHER.